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REMARKS/ARGUMENTS

In the January 21, 2004 Office Action, the Examiner rejected claims 1-3, 5-10, 14-16, 21-24, 27-29, 31-36, 52-54, 56-61, 65-67, 72-80, 82-87, 91-93 and 98-102 pending in the application. This Response cancels claims 14, 27, 65 and 91, without disclaimer or prejudice, and amends claims 1, 24, 52, and 78 for further consideration. After entry of the foregoing amendments, claims 1-3, 5-10, 15-16, 21-24, 28-29, 31-36, 52-54, 56-61, 66-67, 72-80, 82-87, 92-93, and 98-102 (4 independent claims, 56 total claims) remain pending in the application. Reconsideration is respectfully requested.

The Examiner first rejected claims 1-3, 5-10, 14-16, 21-24, 27-29, 31-36, 52-54, 56-61, 65-67, 72-80, 82-87, 91-93, and 98-102 under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement. In particular, the Examiner states that the specification doesn't teach the limitation of establishing a temperature at said contact area by heating and cooling said polishing solution before causing said polishing solution to be distributed to said contact area. Applicants respectfully traverse this rejection.

In response to the Examiner's rejection, Applicants first note that claims 14, 27, 65 and 91 have been cancelled without disclaimer or prejudice. With respect to the remaining claims, Applicants has amended the claims and directs the Examiner to the specification at page 14, lines 19-21 and 28-31 which specifically states that the abrasive-free polishing solution may be heated or cooled before causing the polishing solution to be distributed to the contact area.

The Examiner next rejected claims 1, 2, 14, 21, 24, 27, 28, 52, 53, 65, 75, 78, 79 and 91 under 35 U.S.C. §103(a) as being unpatentable over Kondo et al., JP 11-135466 of which U.S. Patent No. 6,117,775 is considered to be a correct translation (hereinafter "Kondo"), Beardsley et al., U.S. Patent No. 6,135,865 (hereinafter "Beardsley"), and Vanell et al., U.S. Patent No. 5,945,346 (hereinafter "Vanell"). In particular, the Examiner states that Kondo teaches a polishing method for removing a metal surface where the metal is oxidized to form a thin removable oxide film which includes the steps of causing a wafer to contact a polishing pad and rotating the wafer and pad, and supplying a slurry having less than 1 wt% of polishing abrasive between the wafer and the pad. The Examiner further states that although Kondo doesn't describe supplying slurry through a plurality of pores in the pad and through at least one pore in the platen connected to the pad, Beardsley teaches a CMP apparatus which supplies a slurry

through a porous pad and through holes formed in the platen connected to the pad. The Examiner therefore contends that it would have been obvious for one having ordinary skill in the art to modify Kondo's method in light of Beardsley's slurry distributing system because Beardsley teaches that the slurry distributing system is inexpensive and uncomplicated and would distribute slurry more uniformly on the pad to have a more uniform polishing action.

The Examiner further goes on to state that although the prior art does not describe establishing a temperature at the contact area by circulating a heated fluid through the heat conductive platen or by heating or cooling the slurry before distributing it to the contact area, Vanell teaches that chemical reactions are sensitive to the temperature and the reaction rate typically increases with the temperature. The Examiner further states that Vanell teaches circulating fluid to heat or cool the platen to control the rate of reaction of the polishing process and also to heat the platen to ensure the chemicals in the slurry have minimum reaction rate when starting a CMP process. Accordingly, the Examiner contends that it would have been obvious at the time of the invention for one skilled in the art in light of Vanell's teaching of controlling the temperature of the process to heat or cool the platen and also the slurry in order to control the rate of the reaction or to heat the slurry before distributing it to the contact area to ensure the chemicals in the slurry have a minimum reaction rate when starting a CMP process.

Finally, the Examiner states that with reference to claim 24, the friction between the wafer and the polishing member while rotating would establish a temperature at the contact area while polishing or distributing the slurry and that with reference to claims 52 and 78, Kondo discloses the metal to be polished is copper and the down force is 220 g/cm^2 or 3.13 psi. The Examiner also states that the rate of removal of the copper surface would have to be approximately proportional to the contact pressure since a higher pressure would increase polishing rate and a lower pressure would slow down the polishing rate. Applicants respectfully traverse this rejection.

Kondo generally discloses polishing a metal film formed on an insulating film having a groove where the polishing is done with a polishing solution that contains an oxidizer and a substance which renders oxide water-soluble. The polishing solution does not include a polishing abrasive or, alternatively, the polishing solution includes a polishing abrasive at a low concentration of less than 1 wt% which has a pH and oxidation-reduction potential with the

domain of corrosion of the metal film. Beardsley discloses a CMP apparatus having a rotating platen with a recess which has a first portion in communication with a delivery means for delivering slurry into the first portion and a second portion extending under the polishing pad. Slurry is delivered from the first portion of the recess to the second portion of the recess and then to the upper surface of the pad where it aids in the polishing of the substrate. Vanell discloses controlling the temperature of a chemical reaction in a CMP process with a heat exchanger where the heat exchanger is coupled to a platen for both heating and cooling. The heat exchanger heats the platen so that the CMP process is above a predetermined minimum temperature to ensure a minimum chemical reaction rate. Typically, the heat exchanger uses ethylene glycol as the temperature transport/control mechanism to heat or cool the platen.

"The proper approach to the obviousness issue must start with the claimed invention as a whole. 35 U.S.C. §103." Kimberly-Clarke Corp. v. Johnson & Johnson, 745 F.2d 1437, 1448, 223 U.S.P.Q. 603 (CAFC 1984). It is impermissible to first ascertain factually what appellants did and then view the prior art in such a manner as to select from the random facts of that art only those which may be modified, and then utilized to reconstruct appellants' invention from such prior art. In Re Shuman, 361 F.2d 1008, 1012, 150 U.S.P.Q. 54, 57 (CCPA 1966), Interconnect Planning Corp. v. Feil, 227 U.S.P.Q. 541, 550 (CAFC 1985).

Kondo generally discloses polishing a metal film formed on an insulating film having a groove where the polishing is done with a polishing solution that contains an oxidizer and a substance which renders oxide water-soluble. The polishing solution does not include a polishing abrasive or, alternatively, the polishing solution includes a polishing abrasive at a low concentration of less than 1 wt% which has a pH and oxidation-reduction potential with the domain of corrosion of the metal film. Beardsley discloses a CMP apparatus having a rotating platen with a recess which has a first portion in communication with a delivery means for delivering slurry into the first portion and a second portion extending under the polishing pad. Slurry is delivered from the first portion of the recess to the second portion of the recess and then to the upper surface of the pad where it aids in the polishing of the substrate. Vanell discloses controlling the temperature of a chemical reaction in a CMP process with a heat exchanger where the heat exchanger is coupled to a platen for both heating and cooling. The heat exchanger heats the platen so that the CMP process is above a predetermined minimum

temperature to ensure a minimum chemical reaction rate. Typically, the heat exchanger uses ethylene glycol as the temperature transport/control mechanism to heat or cool the platen.

In Applicants' invention, the abrasive-free polishing solution flows through conduits and bores in a platen which is connected to a polishing pad so that the abrasive-free polishing solution flows up through the polishing pad. Using this method, fresh abrasive-free polishing solution is distributed uniformly to the metallized surface of a workpiece. As the abrasive-free polishing solution uniformly contacts the workpiece, a removable surface film containing the metal is formed on the metallized surface. The removable surface film is subsequently uniformly removed by the mechanical abrasive action of the polishing surface of the polishing pad. In this manner, the rate of formation of the removable surface film on the metallized surface by the polishing solution is increased, making abrasion the rate-determining step of the metal removal mechanism. (See page 14, lines 4-14 of Applicants' specification.) Further, the formation of the removable surface film may be facilitated by modifying the temperature during planarization. In particular, the abrasive-free polishing solution may be heated before being delivered to the manifold apparatus (which delivers the abrasive-free polishing solution through the conduits and bores of the platen) or planarization may be facilitated by decreasing the temperature of the system by cooling the abrasive-free polishing solution before delivering it to the manifold apparatus. (See page 14, lines 18-29 of Applicants' specification.) By using the present invention, the metallized surface of a workpiece can be readily formed to a removable surface film by a polishing solution so that abrasion of the metallized surface is the rate-determining step of the planarization process.

Applicants' invention, where heated or cooled slurry is provided to the contact area between a workpiece and a polishing surface by distributing the slurry through a platen connected to the polishing surface, creates an efficient and uniform method to effect the removal rate of a film during an abrasive step for removing the film. Vanell teaches the use of ethylene glycol as a temperature transport/control mechanism to heat or cool the platen (See column 9, lines 47-49.) Applicants' invention improves the process disclosed in Vanell by heating and/or cooling a slurry before transporting to a contact area between a workpiece and a polishing surface, and transporting the slurry to that contact area by routing it through the platen. Therefore, the cooled or heated slurry can also function to cool or heat the platen as it travels

through the bores created in the platen. To further control the temperature of the CMP process, the platen may also be heated and/or cooled with additional means.

It would not have been obvious to one of ordinary skill in the art to combine Kondo, Beardsley and Vanell to arrive at Applicants' claimed invention because 1) Beardsley fails to disclose a bore through the platen through which slurry is delivered through the platen to the polishing pad (but instead discloses a sprinkler hose contained in a recess formed within the platen where the sprinkler hose has a plurality of spray holes), and 2) cooling and/or heating the slurry before routing it through the platen is not taught or suggested by Vanell.

Claims 1-3, 5, 14, 21, 24, 27-29, 31, 52-54, 56, 65, 75, 78-80, 82, and 91 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Kondo, Sato (hereinafter "Sato"), and Vanell. In particular, the Examiner states that although Kondo does not describe supplying slurry through a channel formed in the pad and through at least one pore which is formed in a platen and collinear with the channel, Sato does describe a polishing apparatus where slurry is supplied through a channel formed in the pad and a pore formed in the platen which is collinear with the channel formed in the pad. The Examiner therefore contends it would have been obvious to modify Kondo's method in light of Sato's slurry distribution system because Sato shows that slurry can be distributed uniformly on the pad and therefore would help to more uniformly polish the wafer. The Examiner further states that although the prior art fails to describe establishing the temperature at the contact area by circulating a heated fluid through the heat conductive platen or by heating or cooling the slurry before distributing it to the contact area, Vanell teaches that the chemical reactions are sensitive to the temperature and the reaction rate typically increases with the temperature in CMP and that the temperature is held within a certain range to control the rate of reaction. Therefore, the Examiner contends that it would have been obvious at the time of the invention for one skilled in the art in light of Vanell's teaching of controlling the temperature of the process to heat or cool the platen and also the slurry in order to control the rate of the reaction, to heat the slurry before distributing it to the contact area to ensure the chemicals in the slurry would have a minimum reaction when starting a CMP process. Applicants' respectfully traverse this rejection.

There is no suggestion in the cited prior art references for combining them in the manner cited by the Examiner. In fact, the above-cited references could not or would not be physically

combined in an operative fashion or to produce the desired result by a person of ordinary skill without the use of the Applicants' teachings. Thus, there can be no *prima facie* obviousness established. In Re Jansson, 609 F.2d 996, 203 U.S.P.Q. 976 (CCPA 1979). In fact, if Applicants' claimed invention requires the steps of causing a polishing solution having less than 1 wt% of a polishing abrasive to be distributed at a contact area between a workpiece and a polishing member through at least one bore formed in a platen connected to the polishing member to effect a removal rate, and the step of establishing a temperature at the contact area by heating or cooling the polishing solution before causing the polishing solution to be distributed to the contact area and controlling the temperature at the contact area by circulating a heat exchange fluid through at least a portion of the platen.

Although Vanell discloses the step of using ethylene glycol as a temperature transport/control mechanism to heat or cool the platen and Sato discloses a platen having a slurry supply port contained therethrough, it would not be obvious to one of ordinary skill in the art to combine these references to arrive at both steps claimed in Applicants' invention without using the teachings provided in Applicants' specification. Moreover, when viewing the figures disclosed in Sato for distributing slurry through the platen, a method for providing a heat exchange or using ethylene glycol as the temperature transport/control mechanism to heat or cool the platen would not be readily apparent or obvious to one of ordinary skill in the art.

Claims 6-10, 15, 16, 32-36, 57-61, 66, 67, 83-87, 92 and 93 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Kondo/Beardsley/Vanell or Kondo/Sato/Vanell as applied to claims 1, 2, 3, 28, 29, 52, 53, 54, 78, 79 and 80 above, and further in view of Berman et al., U.S. Patent No. 5,882,251 (hereinafter "Berman"). In particular the Examiner states that Berman discloses that using a polishing pad having grooves is well known to one skilled in the art as a way for slurry distribution and improved pad-wafer contact. The Examiner further states that Berman discloses that the grooves can intersect the channel on the pad and that the first grooves are perpendicular to the second grooves.

Finally, claims 22, 23, 72-74, 76, 77 and 98-102 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Kondo/Beardsley/Vanell or Kondo/Sato/Vanell as applied to claims 21, 52, 72 and 78 above, and further in view of admitted prior art. In particular, the Examiner states that although Kondo fails to describe the pressure as being from about 0.10 to 3 or from

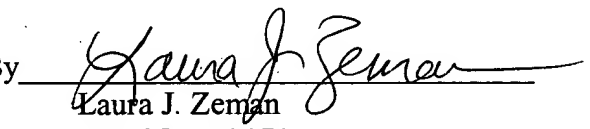
0.10 to 1 psi, Kondo teaches a pressure of 220 g/cm^2 or 3.129 psi and further teaches that the down force is not limited to this. The Examiner then states that using a pressure such as that claimed by Applicants is well known in practice by one skilled in the art in order to avoid disadvantage such as edge effects and that it therefore would have been obvious to one of ordinary skill in the art at the time of the invention to use low pressure such as 0.1 to 1 psi in order to avoid defects such as edge effects and scratch on the wafer. Finally, with respect to claims 72-74 and 98-100, the Examiner states that the admitted prior art shows that forming structure having less than 0.18 μm and using lower dielectric constant material for isolation of these structures is desired to increase performance speed. The Examiner therefore contends it would have been obvious to one of ordinary skill in the art to apply Kondo's method to form structure having small size such as less than 0.18 μm dimensions to produce a faster device.

All of the claims contained in the Examiner's final 35 U.S.C. §103(a) rejections include the limitations contained in those claims previously rejected by the Examiner under 35 U.S.C. §103(a) when citing Kondo/Beardsley/Vanell or Kondo/Sato/Vanell. Accordingly, Applicants reaffirm their nonobviousness arguments and herein incorporate the same by reference.

In view of the foregoing, Applicants respectfully submit that all of the pending claims are allowable over the prior art of record. Reconsideration of the application and allowance of all pending claims is earnestly solicited. Should the Examiner wish to discuss any of the above in greater detail or deem that further amendments should be made to improve the form of the claims, then the Examiner is invited to telephone the undersigned at the Examiner's convenience.

Dated: May 20, 2004

Respectfully submitted,

By 

Laura J. Zeman
Reg. No. 36,078

SNELL & WILMER L.L.P.
One Arizona Center
400 East Van Buren
Phoenix, Arizona 85004-2202
Telephone: (602) 382-6377
Facsimile: (602) 382-6070

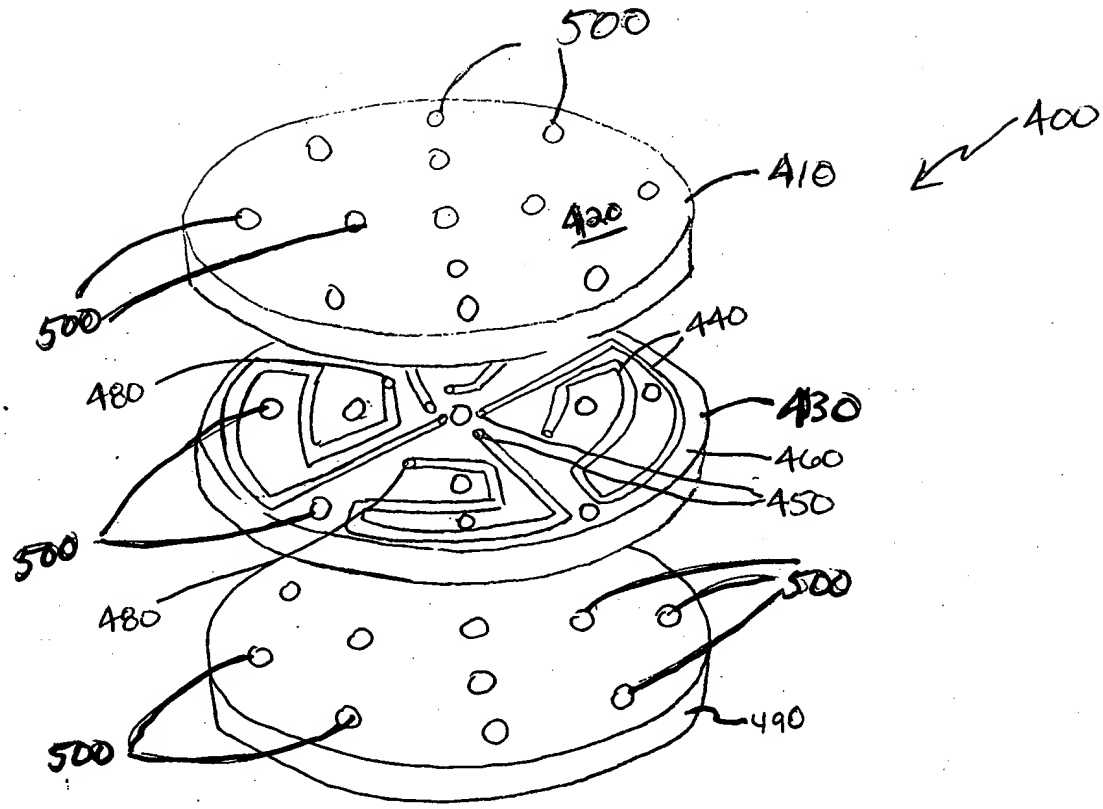


Fig. 8